REMARKS

Claims 57, 62, 72, 76 and 77 are amended. Claims 78-81 are added. Claims 57-81 are in the application.

The specification is amended to correct a typographical error.

The title is amended as requested by the Examiner.

The Abstract is amended to be less than 150 words.

Claims 57 and 62 are objected to with an allegation that the phrase "to diffusion" is grammatically incorrect. The undersigned sees no grammatical incorrectness with respect to this language. Claims 57 and 62 are nevertheless amended to recite "a conductive diffusion barrier layer effective to restrict diffusion" in an effort to overcome the Examiner's rejection. Such amendments are not seen in any to limit claims 57 and 62 as previously presented, and such added language was inherently already in such claims. Withdrawal of this rejection with respect to claims 57 and 62 is requested.

The dependency of claims 76 and 77 has been changed to depend from claim 57. Therefore, the Examiner's rejection of these claims should be withdrawn.

Claims 66 and 68 stand rejected under 35 U.S.C. § 112 first paragraph. The Examiner is in error. Specifically with respect to claim 66, the Examiner alleges that there is no support for semiconductive material within the insulating material which does not contact the conductive diffusion barrier layer of the gate. The Examiner's attention is directed to Fig. 5 and the

specification at p.8, ln.17 - p.9, ln.5. Accordingly, support for the subject claim is inherent from Applicant's application as filed, and this rejection must be withdrawn. Action to that end is requested.

With respect to claim 66, the Examiner alleges that there is no support for a silicide layer and a conductive diffusion barrier layer comprising the same material. However, claim 66 does not recite the same "material", but rather that the silicide and the conductive diffusion barrier layer comprise the same metal. Accordingly, claim 66 refers to "the same metal", not the same "material". Further, Applicant must have had possession of this subject matter at the time of filing as Applicant's claim 20 includes such disclosure/subject matter. Applicant's claims as-filed as a matter of law constitute a part of the subject matter of Applicant's application disclosure. Further, Applicant gives an example in the specification at p.5, lns.16-17 of a preferred material as being $TiSi_x$. Further, Applicant gives example barrier layer material compounds on the same page at line 24 as including TiN, TiO_xN_y, and TiW_xN_y. Clearly, such materials, by way of example only, comprise the same metal, namely Ti. Accordingly, it is not seen how it can be reasonably asserted that Applicant did not possess that which it inherently disclosed at the time of filing. Accordingly, withdrawal of this rejection is urged, and action to that end is requested.

With respect to the prior art rejections, the undersigned notes that there is no literal rejection of claim 57. Yet, certain claims depending from

claim 57 are rejected under § 102 over Thakur et al., Chow et al. and Ku. As each of such dependent claims inherently depend from claim 57, the rejections which the Examiner provides thereof are also taken to include a § 102 rejection of claim 57, and are so treated below.

Claims 57 and 58 stand rejected under § 102 as being anticipated by Thakur et al. Applicant disagrees and requests reconsideration. Specifically, the Examiner erroneously asserts that the conductive diffusion barrier layer of Thakur comprises "TiWxNy, WxNy". The Examiner is in error. Specifically, Thakur et al. in Fig. 3 shows a conductive barrier layer 56 as part of its gate construction 40. Col.5, lns.47-49 disclose the only possible materials for such layer as being tungsten nitride, tungsten silicon nitride or titanium silicon nitride. However, TiW_xN_y is not disclosed. Therefore, claim 57 is not anticipated by Thakur et al., and the Examiner is in error.

Dependent claim 58 recites that the conductive diffusion barrier layer comprises W_xN_y. As such claim depends from claim 57, claim 58 requires that conductive diffusion barrier layer to comprise both TiW_xN_y and W_xN_y. As is argued above with respect to claim 57, Thakur et al. does not disclose TiW_xN_y as a conductive diffusion barrier layer in a field effect transistor, and claim 58 therefore cannot be concluded to be anticipated over Thakur et al. Withdrawal of this rejection is warranted and requested.

Claims 57 and 58 stand rejected under § 102 as being anticipated by Chow et al. Applicant disagrees and requests reconsideration.

Specifically, Chow et al. discloses conductive layers 25 and 25a as part of its depicted gate constructions. However, structure 25 is only disclosed as constituting tungsten (col.2, ln.33), and layer 25a is only disclosed as constituting tungsten nitride (col.2, ln.60). Again, TiW_xN_y is not disclosed. Accordingly, claim 57 is not anticipated by Chow et al. As claim 57 is not anticipated by Chow et al., claim 58 depending therefrom by definition cannot be anticipated by Chow et al. Further, Chow et al. does not disclose a conductive diffusion barrier layer as part of the field effect transistor which includes both TiW_xN_y and W_xN_y. Accordingly, the anticipation rejection of claim 58 is in error and must be withdrawn. Action to that end is requested.

Claims 57 and 59 stand rejected under § 102 over Ku. Applicant disagrees and requests reconsideration.

Ku is only seen as pertinent in its disclosure of a diffusion barrier layer as part of a gate construction which can comprise TiON. However, the only materials which Ku discloses for its conductive diffusion barrier layer are TiN or TiNO (col.11, lns.35-37). Again, TiW_xN_y is not disclosed. Accordingly, Ku does not disclose all the limitations of Applicant's independent claim 57 and the anticipation rejection thereof over Ku must be withdrawn. Action to that end is requested.

With respect to claim 59, such depends from claim 57 and thereby cannot be anticipated by Ku if claim 57 is not anticipated. Further, claim 59 recites that the conductive diffusion barrier layer of a field effect transistor

includes both TiW_xN_y and TiO_xN_y. Ku does not disclose such a combination. The rejection is therefore in error and withdrawal is requested.

Independent claim 57 and claim 60 depending therefrom stand rejected as being obvious over a combination of Ku, Visokay et al. and Igarashi. Applicant disagrees and requests reconsideration. Specifically, Ku is inapplicable as argued above, as it does not disclose TiW_xN_y as a diffusion barrier layer in a field effect transistor gate construction. Visokay et al. is apparently relied upon as disclosing the possibility of TiW_xN_y as a conductive diffusion barrier layer at col.9, ln.4. However, such disclosure is only relative to a storage node construction of a capacitor, and not in conjunction with a gate in a field effect transistor.

Regarding Igarashi, the Examiner relies upon col.4, lns.4-9 where it is disclosed that a gate electrode is formed of ***"any one material"*** selected from a long list of conductors which includes TiWN.

Yet, Applicant's independent claim 57 claims a gate construction including a combination of at least conductively doped semiconductive material, a silicide, and TiW_xN_y. Igarashi only discloses using a single material for the conductive portion of its gate, and Visokay et al. is not in any way directed to conductive material construction of a gate.

Accordingly, none of Ku, Visokay et al. or Igarashi discloses the concept of utilizing TiW_xN_y as a conductive diffusion barrier layer in a gate construction also including conductively doped semiconductive material and a

silicide layer, whether taken alone or in combination. As none of the reference discloses these facets of Applicant's claim 57, the combination of such references clearly does not. Further, there is no suggestion or motivation to combine the three references to reach a conclusion of obviousness. Accordingly, the Examiner's obvious rejection of claim 57 should be withdrawn and action to that end is requested.

Regarding dependent claim 60, such should be allowed as depending from an allowable base claim, and for its own recited features which are neither shown nor suggested in the collective art. Action to that end is requested.

Independent claim 57 also stands rejected under § 103 as being obvious over a combination of Bai et al., Visokay et al. and Igarashi. Bai et al. merely discloses the possibility of a conductive diffusion barrier layer which comprises TiN, and does not disclose TiW_xN_y, as the Examiner so admits. Visokay et al. and Igarashi are referred to immediately above and are equally lacking as argued individually, and both as in a combination with Bai et al. Further, there is no suggestion or motivation to combine the three references to reach a conclusion of obviousness. Accordingly, independent claim 57 should be allowed over these references, and action to that end is requested.

Claim 61 should be allowed as depending from an allowable base claim, and for its own recited features which are neither shown nor suggested in the cited art. Action to that end is requested.

Independent claim 62 stands rejected as being anticipated over Pfeister. Claim 62 has been amended to recite a contact structure which extends through the insulative material to the gate, with the contact structure including semiconductive material provided in electrical connection with the gate, and with the semiconductive material provided through the insulative material being conductively doped with the conductivity enhancing impurity of a second type. The Examiner relies upon material 20 of Pfeister as constituting Applicant's above claimed subject matter.

However, as amended, Applicant recites a contact structure which extends through the subject insulative material. Layer 20 in Pfeister is neither a contact structure nor does it extend through the surrounding insulative material 30/44. Accordingly, claim 62 as amended positively recites something which is not disclosed by Pfeister, and the anticipation rejection thereof should be withdrawn. Action to that end is requested.

Claims 63, 67 and 70 also stand rejected as being anticipated by Pfeister. As each depends from claim 62, and as claim 62 is not anticipated by Pfeister, each of these claims by definition cannot be anticipated, and the rejection thereof under § 102 should be withdrawn. Action to that end is requested.

Applicant's dependent claims 64-66, 68, 69 and 71-77 stand rejected as being obvious over a combination of Pfeister with other references. The inapplicability of Pfeister in light of Applicant's amended claim 62 is argued above. The other cited references with respect to the dependent claim combinations do not overcome the deficiency identified above with respect to Pfeister. Such dependent claims should accordingly be allowed as depending from an allowable base claim, and for their own recited features which are neither shown nor suggested in the cited art. Action to that end is requested.

Dependent claims 78-81 are added. Such should be allowed as depending from allowable base claims, and for their own recited features which are neither shown nor suggested in the cited art. Action to that end is requested.

This application is believed to be in immediate condition for allowance, and action to that end is requested.

Respectfully submitted,

Dated: 4-26-01

By _____
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Serial No. 09/730,335
Filing Date . . . . . December 4, 2000
Inventor . . . . . Charles H. Dennison
Assignee . . . . . Micron Technology, Inc.
Group Art Unit 2811
Examiner . . . . . Ori Nadav
Attorney's Docket No. MI22-1577
Title: Field Effect Transistors and Integrated Circuitry

VERSION WITH MARKINGS TO SHOW CHANGES MADE ACCOMPANYING RESPONSE TO FEBRUARY 26, 2002 OFFICE ACTION

In the Title

The title has been replaced.

In the Abstract

The Abstract has been replaced.

In the Specification

The replacement specification paragraphs incorporate the following amendments. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

The paragraph beginning at line 8 on page 2 has been amended as follows:

In certain applications, it may be desirable that the conductive plugging material be a semiconductive material having opposite type conductivity enhancing dopant impurity as compared to the conductivity type impurity within the semiconductive material of the gate. For example where the gate is heavily doped to achieve conductivity with n-type material, in some applications it might be desirable to provide a conductively doped contact plug to that gate with p-type material. Unfortunately, the different ~~dopants~~ dopant types can easily cross-diffuse relative to one another through the silicide which can lead to no conductive connection. One prior art solution to avoiding this diffusion is to initially line the contact opening with a very thin layer of an electrically conductive diffusion barrier material, such as TiN. Subsequently, the remaining portion of the opening is filled with conductively doped polysilicon to provide the desired electrical connection with the transistor gate.

In the Claims

The claims have been amended as follows. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

57. (Amended) A field effect transistor comprising:

a pair of source/drain regions having a channel region positioned therebetween; and

a gate positioned operatively proximate the channel region, the gate comprising semiconductive material conductively doped with at least one of a p-type or n-type conductivity enhancing impurity effective to render the semiconductive material electrically conductive, a silicide layer and a conductive diffusion barrier layer effective to restrict diffusion of p-type or n-type conductivity enhancing impurity, the conductive diffusion barrier layer comprising TiW_xN_y.

62. (Amended) Integrated circuitry comprising:

a field effect transistor including a gate, a gate dielectric layer, source/drain regions and a channel region; the gate comprising semiconductive material conductively doped with a conductivity enhancing impurity of a first type and a conductive diffusion barrier layer effective to restrict diffusion of first or second type conductivity enhancing impurity; and

insulative material received proximate the gate, ~~the insulative material~~ a contact structure extending through the insulative material to the gate, the contact structure including semiconductive material provided ~~therein~~ in electrical connection with the gate, the semiconductive material provided ~~within~~ through the insulative material being conductively doped with a conductivity enhancing impurity of a second type, the conductive diffusion barrier layer of the gate being provided between the gate semiconductive material and the semiconductive material provided ~~within~~ through the insulative material.

72. (Amended) The transistor of claim 62 wherein the conductive diffusion barrier layer ~~is~~ comprises a material selected from the group consisting of W_xN_y, TiO_xN_y, and TiW_xN_y, and mixtures thereof.

76. (Amended) The transistor of claim ~~62~~ 57 wherein the conductive diffusion barrier layer is formed over the silicide layer.

77. (Amended) The transistor of claim ~~62~~ 57 wherein the silicide layer is formed over the conductive diffusion barrier layer.

Claims 78-81 are added.

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